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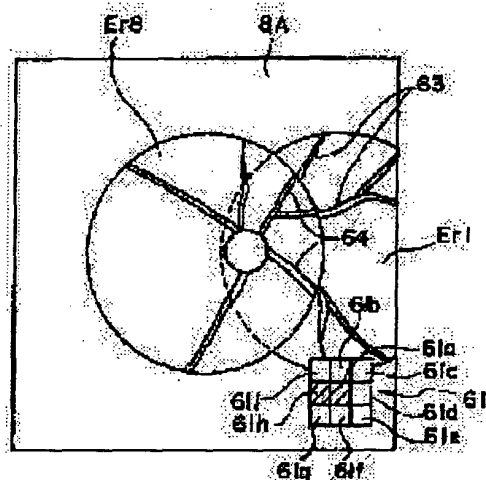
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## (54) OPHTHALMIC IMAGING DEVICE

## (57)Abstract:

PROBLEM TO BE SOLVED: To produce panoramic images of regions to be imaged by photographing these regions with an observed one yet to be imaged interrelated intuitively with another or others having been imaged.

SOLUTION: The ophthalmic imaging device observes, as observation regions, partial regions to be imaged Er1 to Er8, by way of example, out of the whole region of an eye to be examined, and photographs the imaging regions Er1 to Er8, before displaying on a screen 8A a panoramic image consisting of interrelated still pictures obtained from the imaging. A display control means is provided to produce a movie display of the observation regions related to the still pictures on the screen 8A.



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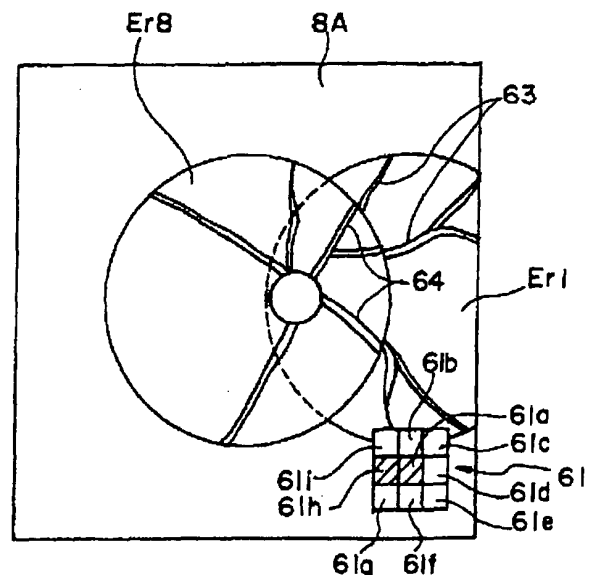
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(54)【発明の名称】眼科撮影装置

(57)【要約】

【課題】 これから撮影しようとする撮影すべき部位を  
観察しているときに、すでに撮影が終わっている撮影部  
位との相互関係を直感的に把握しつつ撮影を行ってパノ  
ラマ画像を得ることのできる眼科撮影装置を提供する。

【解決手段】 この発明の眼科撮影装置は、被検眼の全  
体に対する部分としての撮影すべき部位Er1~Er9  
を観察部位として観察した後、撮影すべき部位Er1~  
Er9を撮影してこの撮影により得られた静止画Er  
1'~Er9'を相互に関連づけてパノラマ画像として  
画面8Aに表示し、画面8Aに静止画Er1'~Er  
9'と関連づけて観察部位が動画で表示されるように制  
御する表示制御手段が設けられている。



## 【特許請求の範囲】

【請求項1】 被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に前記静止画と関連づけて前記観察部位が動画で表示されるように制御する表示制御手段が設けられていることを特徴とする眼科撮影装置。

【請求項2】 前記表示制御手段は前記観察部位が前記画面上の中央部分に表示されかつ前記観察部位に関連づけられる静止画が前記画面上の周辺部に表示されるように制御することを特徴とする請求項1に記載の眼科撮影装置。

【請求項3】 前記被検眼のディオブターに基づいて前記画面上での表示倍率を補正する表示倍率補正手段が設けられている請求項1に記載の眼科撮影装置。

【請求項4】 前記撮影すべき部位が眼底部位であることを特徴とする請求項3に記載の眼科撮影装置。

【請求項5】 被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に互いに関連づけて表示された各静止画のいずれかを画面上で指定する指定手段と、該指定手段により指定された静止画の画面上での輝度を調整する輝度調整手段とを備えている眼科撮影装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、被検眼の眼底、角膜内皮、角膜断面等の撮影部位を撮影する眼科撮影装置の改良に関する。

## 【0002】

【従来の技術】従来から、被検眼の眼底、角膜内皮、角膜断面等の撮影部位を撮影する眼科撮影装置が知られている。この種の眼科撮影装置、例えば、眼底を撮影する眼底カメラでは、眼底の全体に対する部分としての撮影すべき各部位を観察部位（アライメント画像）としてモニタの画面上に動画で表示し、この画面上に表示された各観察部位を観察しつつそれぞれ撮影して、この撮影により得られた撮影すべき各部位を静止画としてスチルビデオレコーダー等に記録し、この撮影により得られた各静止画を相互に関連づけてパノラマ画像として画面に表示するようにしている。

## 【0003】

【発明が解決しようとする課題】しかしながら、この種の眼科撮影装置では、各眼底部位を関連づけてモニタの画面上に静止画として表示するものとしたとき、得られた各静止画を関連づけて貼り合わせて合成する作業が煩わしく、各静止画を間違えて関連づけるおそれもあり、

被検眼の全体を広い範囲で検査する場合に問題になっている。

【0004】そこで、特開平9-173298号公報に開示のものでは、被検眼の撮影すべき部位を選択する位置選択手段を設け、撮影すべき部位を撮影により静止画として記録手段に記録すると共に位置選択手段により選択された撮影位置を記録手段に記録し、画像制御手段が撮影位置に基づいて各静止画を関連づけて画面に表示させるようにしている。

【0005】このものによれば、得られた各静止画を関連づけて貼り合わせて合成する作業に煩わされることなく、また、各静止画を間違えて関連づけるおそれもない。

【0006】ところが、この特開平9-173298号公報に開示のものでは、被検眼を観察しているときには、すでに撮影の終わっている撮影部位が画面上に表示されず、画面上にはこれから撮影しようとする撮影すべき部位が動画で表示されるのみであるので、これから撮影しようとする撮影すべき部位を観察しているときにすでに撮影が終わっている撮影部位との相互関係を直感的に把握しにくいという問題がある。

【0007】本発明は、上記の事情に鑑みて為されたもので、その目的とするところは、これから撮影しようとする撮影すべき部位を観察しているときに、すでに撮影が終わっている撮影部位との相互関係を直感的に把握しつつ撮影を行ってパノラマ画像を得ることのできる眼科撮影装置を提供することにある。

## 【0008】

【課題を解決するための手段】本発明の請求項1に記載の眼科撮影装置は、被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に前記静止画と関連づけて前記観察部位が動画で表示されるように制御する表示制御手段が設けられていることを特徴とする。

【0009】本発明の請求項2に記載の眼科撮影装置は、前記表示制御手段は前記観察部位が前記画面上の中央部分に表示されかつ前記観察部位に関連づけられる静止画が前記画面上の周辺部に表示されるように制御することを特徴とする。

【0010】本発明の請求項3に記載の眼科撮影装置は、前記被検眼のディオブターに基づいて前記画面上での表示倍率を補正する表示倍率補正手段が設けられていることを特徴とする。

【0011】本発明の請求項4に記載の眼科撮影装置は、前記撮影すべき部位が眼底部位であることを特徴とする本発明の請求項5に記載の眼科撮影装置は、被検眼の全体に対する部分としての撮影すべき部位を観察部位として観察した後、前記撮影すべき部位を撮影してこの

撮影により得られた静止画を相互に関連づけてパノラマ画像として画面に表示する眼科撮影装置であって、前記画面に互いに関連づけて表示された各静止画のいずれかを画面上で指定する指定手段と、該指定手段により指定された静止画の画面上での輝度を調整する輝度調整手段とを備えていることを特徴とする。

#### 【0012】

【発明の実施の形態】図1は本発明に係わる眼科撮影装置の一例としての無散瞳タイプの眼底カメラの外観図を示し、この図1において、1Aはベース、1Bは架台、1Cは装置本体、2は顎受け、3は顎当て、4は外部固視灯、5Aはジョイスティック、5Bは撮影スイッチ、6はTVカメラであり、これらの構成は公知である。

【0013】装置本体の内部には、図2に示すように被検眼Eの眼底Erを照明するための照明光学系10と眼底Erを撮影する撮影光学系20と、観察光学系20'と、眼底Erに固視標を投影して被検眼を固視させるための内部固視標投影光学系50と、被検眼に対する装置本体の位置合わせを行うためのアライメント光学系（図示を略す）とを備えている。

【0014】照明光学系10は対物レンズ11と、孔空きミラー12と、リレーレンズ13と、反射ミラー14と、リレーレンズ15と、被検眼Eの瞳孔Eaと共役関係に保たれたリング開口16Aを有するリング開口板16と、コンデンサレンズ17と、照明光源18とを有している。

【0015】照明光学系10は観察時には赤外光により眼底を照明し、撮影時には可視光により眼底を照明するもので、その構成は公知であるのでその詳細な説明は省略する。

【0016】撮影光学系20は、対物レンズ11と、合焦レンズ21と、結像レンズ22と、反射ミラー23を有し、TVカメラ6は撮像素子6aを有する。TVカメラ6はフィールドレンズ24と、反射ミラー25と、リレーレンズ26とからなるリレーレンズ系25Aを介して撮影光学系20に光学的に接続されている。その撮像素子6aは眼底Erと光学的に共役関係に維持される。

【0017】観察光学系20'はダイクロイックミラー23'、反射ミラー25'、リレーレンズ26'、TVカメラ6'を有する。ダイクロイックミラー23'は赤外光を反射し、可視光を透過する特性を有する。

【0018】TVカメラ6は画像記録器機器としてのステルビデオレコーダー7に接続され、このステルビデオレコーダー7はモニター8に接続されている。そのモニター8には、その画面8Aに被検眼の眼底を撮影するとき眼底の全体に対する部分としての撮影すべき部位が観察部位として動画で表示される。

【0019】検査者はその観察部位を観察しつつアライメントを行って撮影を行う。その撮影すべき部位は静止画

チルビデオレコーダー7に記録された静止画は画面8Aに表示されるようになっている。そのモニター8、ステルビデオレコーダー7は制御装置9によって制御され、その制御の詳細は後述する。

【0020】内部固視標投影光学系50は、図3に示すように、中心に配置された発光ダイオード51a及びこの発光ダイオード51aの周囲に等間隔に正形状に配置された8個の発光ダイオード51b〜51iと、図4に示すように各発光ダイオード51a〜51iに対向して設けられたピンホール52a〜52iを有するマスク板52と、ハーフミラー53と、結像レンズ22と、合焦レンズ21と、対物レンズ11とからなる。

【0021】この発光ダイオード51a〜51iの光はピンホール52a〜52i、ハーフミラー53、結像レンズ22、合焦レンズ21、対物レンズ11を介して眼底Erに固視標として投影され、眼底Erにピンホール像が結像され、被検者はこの固視標を視認することにより固視が固定され、このピンホール52a〜52iのいずれを点灯させるかによって、撮影光学系20の光軸Oに対する被検者の固視の方向が切り換えられ、これにより眼底Erの撮影すべき部位が変更されるものである。ここでは、眼底Erの撮影すべき部位は図5に示すように9個とした。

【0022】発光ダイオード51aを点灯させると、中央の撮影すべき部位Er1が撮影され、発光ダイオード51bを点灯させると、真上の撮影すべき部位Er2が撮影され、発光ダイオード51cを点灯させると、右斜め上の撮影すべき部位Er3が撮影され、発光ダイオード51dを点灯させると、右横の撮影すべき部位Er4が撮影され、発光ダイオード51eを点灯させると、右斜め下の撮影すべき部位Er5が撮影され、発光ダイオード51fを点灯させると、真下の撮影すべき部位Er6が撮影され、発光ダイオード51gを点灯させると、左斜め下の撮影すべき部位Er7が撮影され、発光ダイオード51hを点灯させると、左横の撮影すべき部位Er8が撮影され、発光ダイオード51iを点灯させると、左斜め上の撮影すべき部位Er9が撮影されるようになっている。

【0023】モニター8の画面8Aには、図6に示すように、撮影の前には、眼底Erの全体に対する部分としての撮影すべき部位がアライメント画像として表示される。このアライメント画像は動画である。この図6では、被検眼が発光ダイオード51aを固視しているものとして、画面8Aにはその略中央部に撮影すべき部位Er1が動画で表示されている。

【0024】制御装置9はマウス等の操作手段60を有し、画面8Aには操作手段60を操作することにより、アライメント画像、静止画像と共に、眼底Erの全体に対する撮影すべき部位の位置を認識させる認識パターンが表示される。眼底部位Er1〜Er9については

未撮影であるので、図6においては、撮影すべき部位Er1のみが表示され、後述する静止画は表示されていない。

【0025】認識パターン61は、ここでは、9個の升目61a~61iから構成され、この9個の升目61aないし61iは撮影部位Er1~Er9にそれぞれ対応する位置関係をもって配置されている。この認識パターン61は、例えば撮影すべき部位の撮影が実行されると、その撮影すべき部位に対応する升目の輝度が高くなるようにされ、全く撮影の行われていない状態では、各升目61a~61iの輝度は低輝度であり、例えば、中央の部位Er1のアライメント画像が表示されている状態で撮影スイッチ5Bを操作することにより撮影を実行すると、升目61aが低輝度から高輝度に変更され、これにより、眼底Erの全体に対する撮影すべき部位のいずれの位置の撮影すべき部位の撮影が行われたかが認識される。その撮影すべき部位Er1はスチルビデオレコーダー7に静止画Er1'として記録される。次に、発光ダイオード51hを点灯させて被検眼Eの固視を誘導すると、図7に示すように画面8Aに撮影すべき部位Er8に対応するアライメント画像が動画で表示される。撮影すべき部位Er8は画面8Aの略中央部に表示される。

【0026】操作手段60を操作して画面8A上で所望の静止画（ここでは、Er1'）の呼び出し指定をすると、静止画Er1'が表示されると共に認識パターン61が表示される。この操作手段60を操作して画面8A上で観察を指定すると、静止画Er1'はアライメント画像Erに対して相対位置関係を保って画面8A上の周辺部に移動され、画面8Aには静止画Er1'の一部が表示され、制御装置9と操作手段60とは、画面8A上に静止画と関連づけて観察部位が動画で表示されるように制御する表示制御手段として機能する。

【0027】これにより、これから撮影しようとする撮影すべき部位を観察しているときに、すでに撮影が終わっている撮影部位との相互関係を直感的に把握しつつ撮影を行ってパノラマ画像を得ることができる。また、観察部位を縮小することなく画面上に表示して静止画と観察部位とを関連づけることができる。

【0028】この状態で、撮影スイッチ5Bを操作することにより撮影を実行すると、升目61hが低輝度から高輝度に変更され、眼底撮影部位Er8の撮影部位が実行されたことが画面8Aに表示される。その図7において、撮影が実行されて高輝度になった升目61a、61hを斜線で示す。同時に、眼底撮影部位Er8がスチルビデオレコーダー7に記録される。制御装置9は各撮影部位Er1~Er9をスチルビデオレコーダー7に記録する際に、各撮影部位Er1~Er9と共に撮影部位情報を記録させる。ここでは、撮影部位情報として同一符号Er1~Er9が用いられる

【0029】ところで、この眼科撮影装置では、被検眼のディオプターを0度（正常）とみなして、各撮影すべき部位Er1~Er9の相対位置関係を計算して画面8Aに表示するようにしている。しかしながら、被検眼のディオプターが0度でないとき、すなわち、近視、遠視の被検眼の場合、撮影倍率が異なるため、図8に示すように、撮影済みの静止画とこれに隣接する動画とを精度良くつなげることができないという問題点がある。

【0030】被検眼のディオプターと撮影倍率との間には、一定の関係があるので、図1に示す合焦ハンドル21Aを用いて図2に示す合焦レンズ21を光軸方向に移動させて合焦を行ったときのディオプター値に基づいて、画面8A上での表示倍率を制御装置9により補正するようにすると、図9に示すように撮影済みの静止画とこれに隣接する動画とを精度良くつなげることができる。合焦ハンドル21Aの周囲には、図10に示すように、正視眼位置の基準マーク21B、+a（ディオプタ）、-a（ディオプタ）の目盛21Cが設けられ、合焦ハンドル21Aを操作することにより合焦レンズ21が移動され、合焦した時点で合焦ボタン21Dを押すと、被検眼のディオプターが制御装置9に記憶され、これにより表示倍率の変更が行われる。このとき、制御装置9は被検眼のディオプター値に基づいて表示倍率を補正する表示倍率補正手段として機能する。

【0031】各撮影すべき部位Er1~Er9を撮影し終わって操作手段60を操作すると、画面8Aには図11に示すように静止画Er1'~Er9'により眼底像が全体像（パノラマ画像）として表示される。ここで、各静止画Er1'~Er9'の輝度を見比べてみて、非常に輝度の高い静止画、あるいは、低い静止画があったとする。

【0032】その場合には、その輝度の高い静止画、あるいは、低い静止画をマウス等の操作手段60によりカーソルを移動させてカーソルの位置する画像上でクリックして指定する。すると、その指定された静止画が画面8Aの表面に現れると同時に、画面8Aに輝度調整仮想スライドツマミ62が表示される。

【0033】操作手段60により輝度調整仮想スライドツマミ62を画面上で操作して隣り合う静止画の輝度と違和感のない輝度とすることができ、違和感無く各静止画を連続的につなげて全体の被検眼像を合成できる。

【0034】また、図12に各静止画Er1'~Er9'を並列的に表示し、各静止画Er1'~Er9'の明るさを見比べて、各静止画Er1'~Er9'毎に輝度調整指定を行い、各静止画毎の輝度調整を行っても良い。

【0035】この発明の実施の形態では、固視標としての発光ダイオード51b~51iを発光ダイオード51aを中心にして正方形の配列としたので、図11に示すように眼底像の静止画（眼底像）の重なり部分

少なくすることができるという長所があるが、図13

(a)に示すように発光ダイオード51b~51iを発光ダイオード51aを中心に円周上に配列すると共に、図13(b)に示すようにマスク板52のピンホール52a~52iを発光ダイオード51a~51iに対応させて配列し、図14に示すように静止画Er1'~Er9'を画面8A上に表示するようにしても良い。

【0036】ここでは、眼底中央を中心に80度の範囲内の眼底像が撮影できるようにされているが、100度、120度の範囲内の眼底像を撮影できるようにして

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 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得られたパノラマ画像を説明するための図である。

【図15】内部固視標を可動の構成として得られた動画像を説明するための説明図である。

【図16】外部固視標を用いて従来のパノラマ画像を得る場合の説明図である。

【図17】画面上に静止画Er4'を表示すると共に、撮影すべき部位Er11を動画で円形枠Ci内に表示し

た状態を示す図である。

【符号の説明】

8A…画面

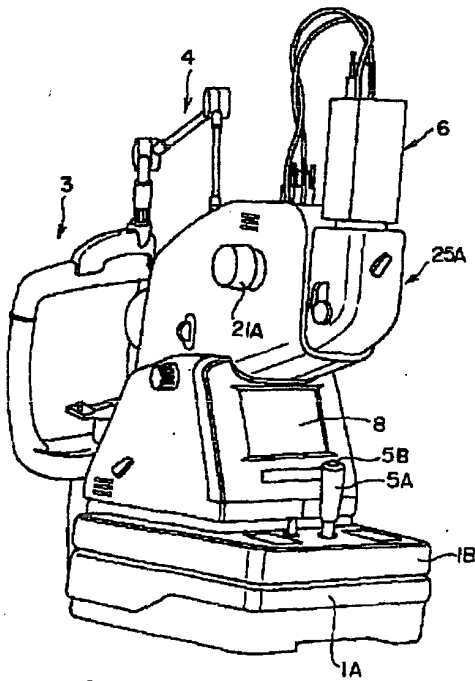
9…制御装置（表示制御手段）

60…操作手段（表示制御手段）

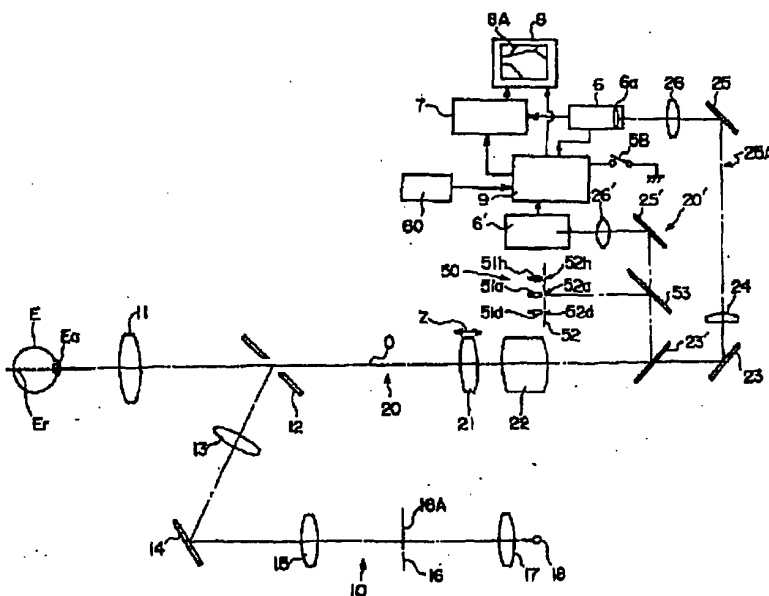
Er1～Er9…撮影すべき部位

Er1'～Er9'…静止画

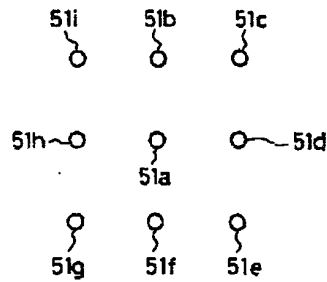
【図1】



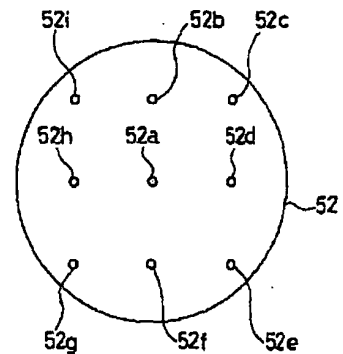
【図2】



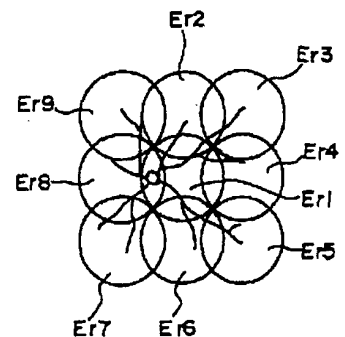
【図3】



【図4】



【図5】



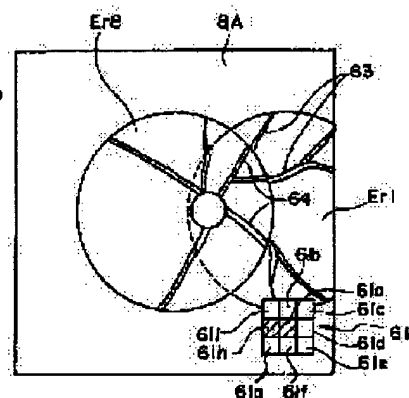


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A61B 3/14  
G02B 7/02  
G03B 15/00  
G03B 17/48

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(72)Inventor : **OKASHITA TOSHIHIRO**  
**KATO TAKEYUKI**

**SOLUTION:** The ophthalmic imaging device observes, as observation regions, partial regions to be imaged Er1 to Er8, by way of example, out of the whole region of an eye to be examined, and photographs the imaging regions Er1 to Er8, before displaying on a screen 8A a panoramic image consisting of interrelated still pictures obtained from the imaging. A display control means is provided to produce a movie display of the observation regions related to the still pictures on the screen 8A.



[Date of request for examination]  
[Date of sending the examiner's decision of rejection]  
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]  
[Date of final disposal for application]  
[Patent number]  
[Date of registration]  
[Number of appeal against examiner's decision of rejection]  
[Date of requesting appeal against examiner's decision of rejection]  
[Date of extinction of right]

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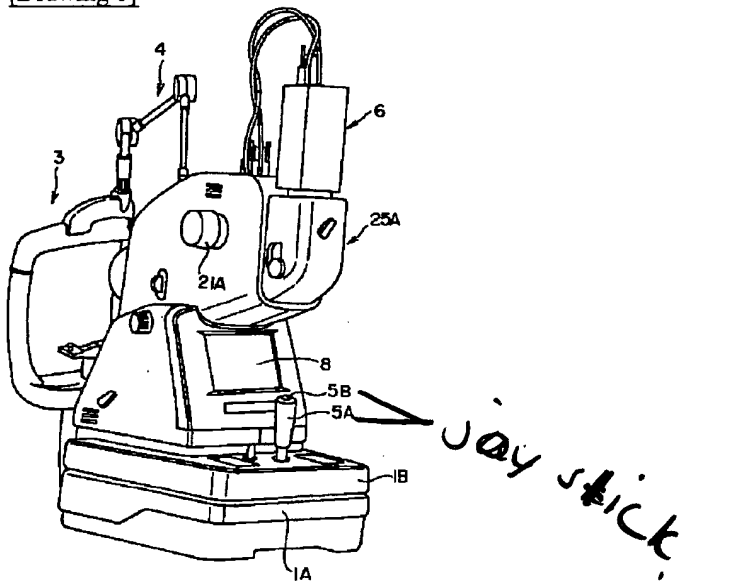
\* NOTICES \*

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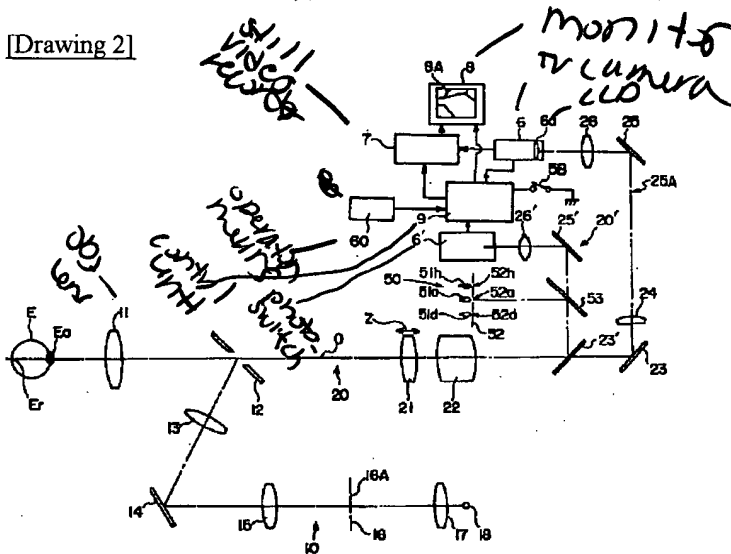
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

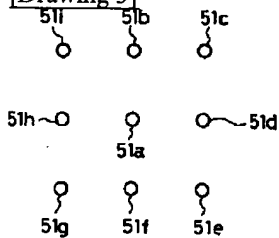
[Drawing 1]



[Drawing 2]

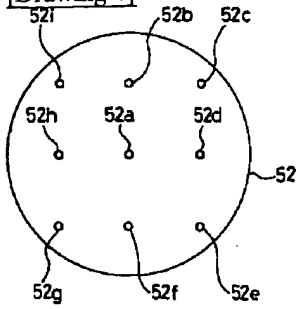


[Drawing 3]

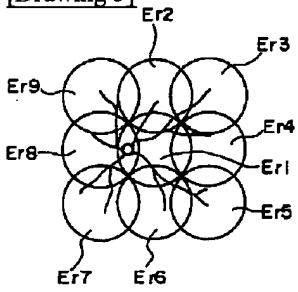




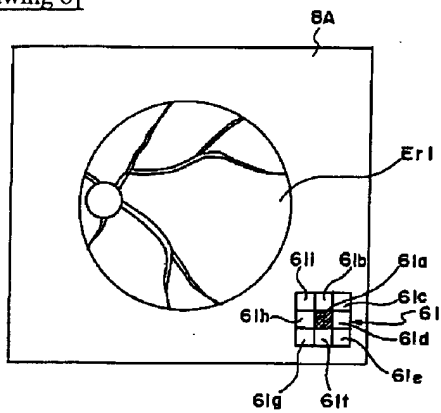
[Drawing 4]



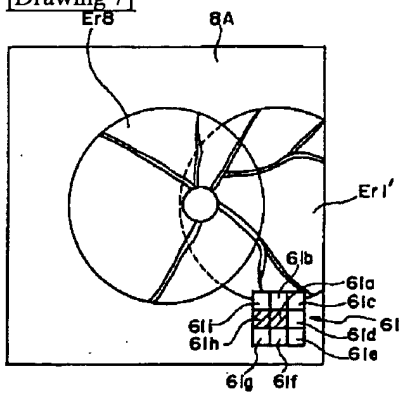
[Drawing 5]



[Drawing 6]

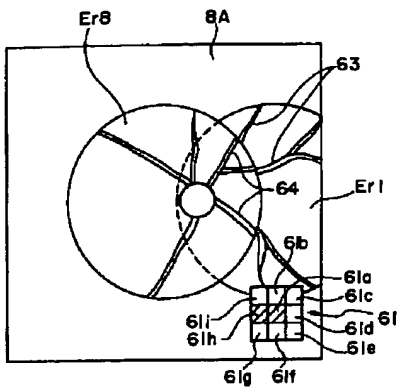


[Drawing 7]

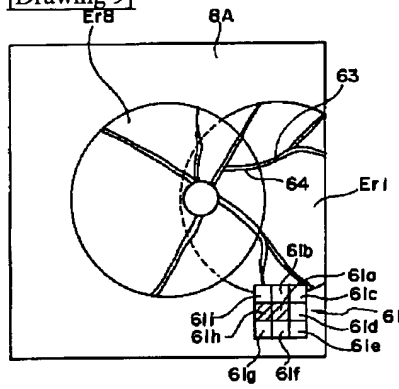


[Drawing 8]

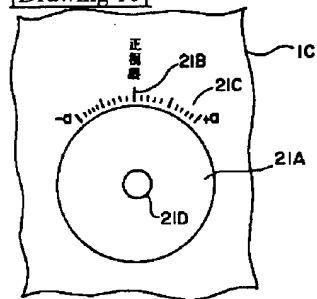




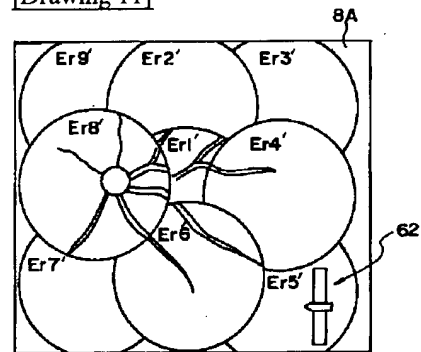
[Drawing 9]



[Drawing 10]



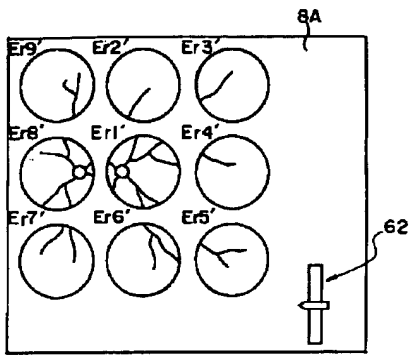
[Drawing 11]



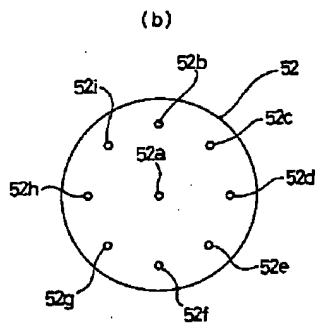
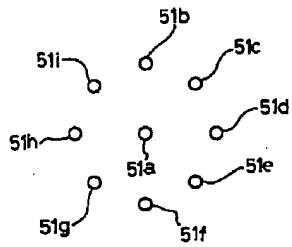
[Drawing 12]



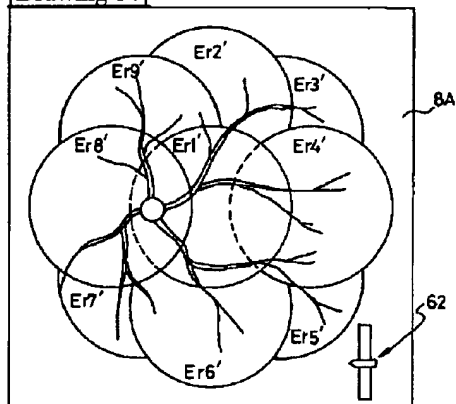




[Drawing 13]  
(a)

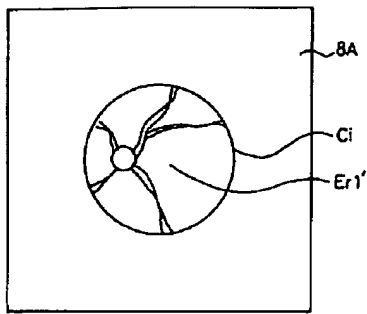


[Drawing 14]

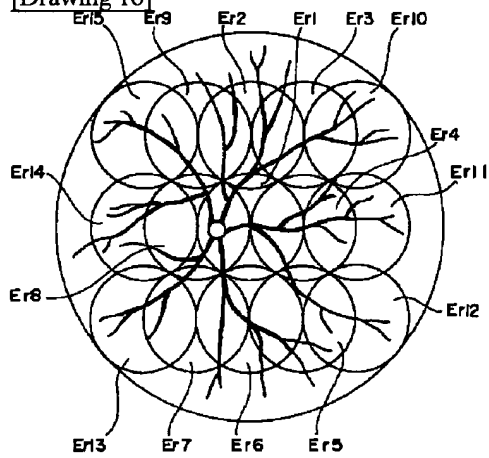


[Drawing 15]

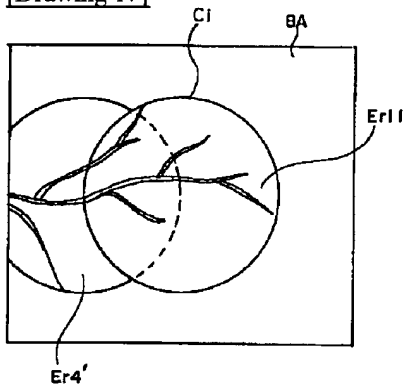




[Drawing 16]



[Drawing 17]



[Translation done.]



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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is the external view of the ophthalmology photography equipment concerning this invention.

[Drawing 2] It is the optical view of the ophthalmology photography equipment concerning this invention.

[Drawing 3] It is drawing showing the array state of light emitting diode shown in drawing 2 .

[Drawing 4] It is the plan of the mask board shown in drawing 2 .

[Drawing 5] It is drawing showing the partition of the eyegrounds part which should be photoed.

[Drawing 6] It is drawing for explaining the state where the part Er1 which should be photoed is displayed on the screen by the animation.

[Drawing 7] It is drawing for explaining the state where the part Er8 which should be photoed while the part [ finishing / photography ] Er1 is displayed by still picture Er1' is displayed by the animation.

[Drawing 8] When the diopter examined the eyes has shifted from the emmetropia, in order that a photography scale factor may change, it is drawing for explaining that still picture Er1' displayed on the screen and the part Er8 which should be photoed shift.

[Drawing 9] It is drawing showing the state where the vessel of still picture Er1' which rectifies a display scale factor and is shown in drawing 8 , and the vessel of the part Er8 which should be photoed were connected correctly.

[Drawing 10] They are the elements on larger scale for explaining the detail of the focus handle shown in drawing 1 .

[Drawing 11] It is drawing showing the state where connected each still picture and it displayed as a panorama picture on the screen.

[Drawing 12] It is drawing showing the state where reduced each still picture and it displayed in parallel on the screen.

[Drawing 13] It is drawing for explaining a modification with the mask board shown in the light emitting diode shown in drawing 3 , and drawing 4 , and (a) shows the modification of the array of light emitting diode, and (b) shows the modification of the array of a pinhole.

[Drawing 14] It is drawing for explaining the panorama picture acquired using the array of the light emitting diode shown in drawing 13 .

[Drawing 15] It is explanatory drawing for explaining the dynamic image obtained considering the internal fixation label as movable composition.

[Drawing 16] It is explanatory drawing in the case of acquiring the conventional panorama picture using an external fixation label.

[Drawing 17] While displaying still picture Er4' on a screen, it is drawing showing the state where the part Er11 which should be photoed was displayed in the circular frame Ci by the animation.

[Description of Notations]

8A -- Screen

9 -- Control unit (display-control means)

60 -- Operation means (display-control means)

Er1-Er9 -- Part which should be photoed

Er1'-Er9' -- Still picture

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[Translation done.]



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to improvement of the ophthalmology photography equipment which photos photography parts, such as eyegrounds examined the eyes, endothelium camerae anterioris, and a cornea cross section.

[0002]

[Description of the Prior Art] From the former, the ophthalmology photography equipment which photos photography parts, such as eyegrounds examined the eyes, endothelium camerae anterioris, and a cornea cross section, is known. With this kind of ophthalmology photography equipment, for example, the fundus camera which photos eyegrounds A photograph is taken, respectively, observing each observation part which expressed as the animation on the screen of a monitor by having made into the observation part (alignment picture) each part grade which should be photoed as the whole eyegrounds portion, and was displayed on this screen. It records on a still video recorder etc. by using as a still picture each part grade which was obtained by this photography and which should be photoed, each still picture obtained by this photography is associated mutually, and it is made to display on a screen as a panorama picture.

[0003]

[Problem(s) to be Solved by the Invention] However, each still picture obtained when each fundus-of-the-eye part should be associated and it should express as this kind of ophthalmology photography equipment as a still picture on the screen of a monitor is associated, the work which sticks and is compounded is troublesome, and there is also a possibility of making a mistake in and associating each still picture, and it has been a problem when inspecting the whole eye examination-ed in the large range.

[0004] Then, while establishing a position selection means to choose as JP,9-173298,A the part which should take [ examined the eyes ] a photograph by the thing of an indication and recording the part which should be photoed on a record means as a still picture by photography, the photography position chosen by the position selection means is recorded on a record means, and picture control means associate each still picture based on a photography position, and it is made to make it display on a screen.

[0005] There is also no possibility of making a mistake in and associating each still picture without troubling to the work which associates each obtained still picture, sticks and is compounded according to this thing.

[0006] however, by the thing of an indication, to this JP,9-173298,A Since it is [ that the photography part which photography has already finished is not displayed on a screen, but the part which it is going to photo from now on and which should be photoed is only displayed by the animation on a screen, and ] while observing the eye examination-ed While observing the part which it is going to photo from now on and which should be photoed, there is a problem of being hard to grasp an interrelation with the photography part which photography has already finished intuitively.

[0007] The place which succeeded in this invention in view of the above-mentioned situation, and is made into the purpose is to offer the ophthalmology photography equipment which can take a photograph, grasping intuitively an interrelation with the photography part which photography has already finished while observing the part which it is going to photo from now on, and which should be photoed, and can acquire a panorama picture.

[0008]

[Means for Solving the Problem] After the ophthalmology photography equipment of this invention according to claim 1 observes the part which should be photoed as the whole eye examination-ed portion as an observation part, It is ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography, and is displayed on a screen as a panorama picture. It is characterized by establishing a display-control means to control so that it relates with the aforementioned still picture and the aforementioned observation part is displayed on the aforementioned screen by the animation.

[0009] The ophthalmology photography equipment of this invention according to claim 2 is characterized by controlling the aforementioned display-control means so that the still picture which the aforementioned observation part is displayed on a part for the center section on the aforementioned screen, and is related with the aforementioned observation part is displayed on the periphery on the aforementioned screen.

[0010] The ophthalmology photography equipment of this invention according to claim 3 is characterized by preparing the display scale factor on the aforementioned screen in the amendment display scale-factor amendment means based on the diopter examined [ aforementioned ] the eyes.





[0011] The ophthalmology photography equipment of this invention to which the aforementioned part to which photography should be carried out is characterized by the ophthalmology photography equipment of this invention according to claim 4 being a fundus-of-the-eye part according to claim 5 After observing the part which should be photoed as the whole eye examination-ed portion as an observation part, It is ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography, and is displayed on a screen as a panorama picture. It is characterized by having a specification means to specify on a screen either of each still picture displayed on the aforementioned screen by relating mutually, and a brilliance-control means to adjust the brightness on the screen of the still picture specified by this specification means.

[0012]

[Embodiments of the Invention] the external view of the non-\*\*\*\* type fundus camera as an example of the ophthalmology photography equipment concerning this invention in drawing 1 -- being shown -- this drawing 1 -- setting -- 1A -- the base and 1B -- a stand and 1C -- for frame reliance and 4, external \*\*\*\*\* and 5A of a joy stick and 5B are [ the main part of equipment, and 2 / a jaw receptacle and 3 / a photography switch and 6 ] TV cameras, and these composition is well-known

[0013] The interior of the main part of equipment is equipped with the lighting optical system 10 for illuminating the fundus of the eye Er examined [ E ] the eyes, as shown in drawing 2, the photography optical system 20 which photos the fundus of the eye Er, observation optical-system 20', the internal \*\*\*\*\* projection optical system 50 for projecting \*\*\*\*\* on the fundus of the eye Er, and making an eye examination-ed \*\*\*\*\*, and the alignment optical system (illustration is omitted) for performing alignment of the main part of equipment to an eye examination-ed.

[0014] the lighting optical system 10 -- an objective lens 11 and a hole -- it has the empty mirror 12, a relay lens 13, the reflective mirror 14, a relay lens 15, the pupil Ea examined [ E ] the eyes and the ring opening board 16 which has ring opening 16A maintained at the conjugate relation, a condensing lens 17, and the lighting light source 18

[0015] The lighting optical system 10 illuminates the fundus of the eye by infrared light at the time of observation, illuminates the fundus of the eye by the light at the time of photography, and since the composition is well-known, it omits the detailed explanation.

[0016] The photography optical system 20 has an objective lens 11, a focussing lens 21, the image formation lens 22, and the reflective mirror 23, and TV camera 6 has image pck-up element 6a. TV camera 6 is optically connected to the photography optical system 20 through relay lens system 25A which consists of the field lens 24, a reflective mirror 25, and a relay lens 26. The image pck-up element 6a is optically maintained by the conjugate relation with the fundus of the eye Er.

[0017] observation -- optical system -- 20 -- ' -- a dichroic mirror -- 23 -- ' -- reflection -- a mirror -- 25 -- ' -- a relay lens -- 26 -- ' -- a TV camera -- six -- ' -- having . Dichroic mirror 23' reflects infrared light, and has the property which penetrates the light.

[0018] TV camera 6 is connected to the still video recorder 7 as an image recording equipment machine, and this still video recorder 7 is connected to the monitor 8. When photoing the fundus of the eye examined the eyes to the screen 8A, the part which should be photoed as the whole fundus of the eye portion is expressed on the monitor 8 as an animation as an observation part.

[0019] A \*\* person takes a photograph by performing alignment, observing the observation part. The part which should be photoed is recorded on the still video recorder 7 as a still picture. The still picture recorded on the still video recorder 7 is displayed on screen 8A. The monitor 8 and the still video recorder 7 are controlled by the control unit 9, and mention the detail of the control later.

[0020] Eight light emitting diodes 51b-51i arranged in the shape of a square at equal intervals around light emitting diode 51a arranged at the center, and this light emitting diode 51a as the internal \*\*\*\*\* projection optical system 50 is shown in drawing 3 , It consists of the mask board 52 which has the pinholes 52a-52i countered and prepared in each light emitting diodes 51a-51i as shown in drawing 4 , a one-way mirror 53, the image formation lens 22, a focussing lens 21, and an objective lens 11.

[0021] The light of these light emitting diodes 51a-51i Pinholes 52a-52i, It is projected on the fundus of the eye Er as \*\*\*\*\* through a one-way mirror 53, the image formation lens 22, a focussing lens 21, and an objective lens 11. By any of these pinholes 52a-52i a \*\*-ed person makes turn [ carry out / image formation of the pinhole image / to the fundus of the eye Er ] on by fixing \*\*\*\* by checking this \*\*\*\*\* by looking The direction of a \*\*-ed person's \*\*\*\* to the optical axis O of the photography optical system 20 is switched, and the part which should photo the fundus of the eye Er by this is changed. Here, the part which should photo the fundus of the eye Er could be nine pieces as shown in drawing 5 .

[0022] If the part Er1 which should photo a center if light emitting diode 51a is made to turn on is photoed and light emitting diode 51b is made to turn on If the part Er2 which should photo right above is photoed and light emitting diode 51c is made to turn on If the part Er3 which should photo the diagonal right is photoed and 51d of light emitting diodes is made to turn on If the part Er4 which should photo the right is photoed and light emitting diode 51e is made to turn on If the part Er5 which should photo the diagonal below is photoed and 51f of light emitting diodes is made to turn on If the part Er6 which should photo right under is photoed and 51g of light emitting diodes is made to turn on If the part Er8 which should photo the left if the part Er7 which should photo the diagonal below is photoed and 51h of light emitting diodes is made to turn on is photoed and light emitting diode 51i is made to turn on, the part Er9 which should photo the diagonal left will be photoed.

[0023] As shown in drawing 6 , before photography, the part which should be photoed as the whole fundus of the eye Er portion is displayed on a monitor's 8 screen 8A as an alignment picture. This alignment picture is an animation. At this drawing 6 , the part Er1 which should be photoed in the abbreviation center section is displayed on screen 8A by the animation as that to which the eye examination-ed is \*\*\*\*(ing) light emitting diode 51a.

[0024] A control unit 9 has the operation meanses 60, such as a mouse, and the recognition pattern 61 which makes the position



of the whole fundus of the eye Er part which should be photoed recognize with an alignment picture and a static image is displayed on screen 8A by operating the operation means 60. Since a photograph has not been taken about the fundus-of-the-eye parts Er2-Er9, in drawing 6, only the part Er1 which should be photoed is displayed and the still picture mentioned later is not displayed.

[0025] The recognition pattern 61 consists of nine grids 61a-61i here, and this nine grid 61a or 61i is arranged with the physical relationship corresponding to the photography parts Er1-Er9, respectively. If photography of the part which should be photoed, for example is performed, the brightness of the grid corresponding to the part which should be photoed this recognition pattern 61 in the state where make it become high and photography is not performed at all. If the brightness of each grids 61a-61i is low brightness, for example, photography is performed by operating photography switch 5B in the state where the alignment picture of the central part Er1 is displayed. Grid 61a is changed into high brightness from low brightness, and it is recognized whether photography of the part which should photo which position of the whole fundus of the eye Er part which should be photoed was performed by this. The part Er1 which should be photoed is recorded on the still video recorder 7 as still picture Er1'. Next, if 51h of light emitting diodes is made to turn on and \*\*\*\* examined [ E ] the eyes is guided, the alignment picture corresponding to the part Er8 which should be photoed to screen 8A as shown in drawing 7 will be expressed as an animation. The part Er8 which should be photoed is displayed on the abbreviation center section of screen 8A.

[0026] If the operation means 60 is operated and call specification of a desired still picture (here Er1') is carried out on screen 8A, while still picture Er1' will be displayed, the recognition pattern 61 is displayed. If this operation means 60 is operated and observation is specified on screen 8A, still picture Er1' will maintain a relative-position relation to the alignment picture Er, and will be moved to the periphery on screen 8A. It functions as a display-control means to control so that a part of still picture Er1' is displayed on screen 8A, a control unit 9 and the operation means 60 are related with a still picture on screen 8A and an observation part is displayed by the animation.

[0027] A photograph can be taken grasping intuitively an interrelation with the photography part which photography has already finished, while this is observing the part which it is going to photo from now on and which should be photoed, and a panorama picture can be acquired. Moreover, without reducing an observation part, it can display on a screen and a still picture and an observation part can be associated.

[0028] It is displayed on screen 8A that 61h of grids was changed into high brightness from low brightness, and the photography part of the fundus-of-the-eye photography part Er8 was performed in this state when photography was performed by operating photography switch 5B. In the drawing 7, a slash shows the grids 61a and 61h which photography was performed and became high brightness. Simultaneously, the fundus-of-the-eye photography part Er8 is recorded on the still video recorder 7. In case a control unit 9 records each photography parts Er1-Er9 on the still video recorder 7, it makes photography part information record with each photography parts Er1-Er9. Here, the same signs Er1-Er9 are used as photography part information.

[0029] By the way, it considers that the diopter examined the eyes is 0 times (normal), and the relative-position relation of the parts Er1-Er9 which should be each photoed is calculated, and it is made to express to screen 8A as this ophthalmology photography equipment. However, since photography scale factors differ when it is [ examined / myopia and / longsighted / the eyes ] when the diopter examined the eyes is not 0 times namely, as shown in drawing 8, there is a trouble that the animation which adjoins a still picture [ finishing / photography ] and this cannot be connected with a sufficient precision.

[0030] the diopter value when focusing by moving the focussing lens 21 shown in drawing 2 using focus handle 21A shown in drawing 1 in the direction of an optical axis, since the fixed relation between the diopter examined the eyes and a photography scale factor was -- being based -- the display scale factor on screen 8A -- a control unit 9 -- an amendment -- if it is made like, the animation which adjoins a still picture [ finishing / photography / as shown in drawing 9 ], and this can be connected with a sufficient precision. Graduation 21C of reference-mark 21B of a stigmatism eye position, +a (diopter), and -a (diopter) is prepared, as shown in drawing 10, if focus button 21D is pushed when a focussing lens 21 is moved and it focuses by operating focus handle 21A, the diopter examined the eyes will be memorized by the control unit 9, and, thereby, a change of a display scale factor will be made to the circumference of focus handle 21A. At this time, a control unit 9 functions based on the diopter value examined the eyes considering a display scale factor as an amendment display scale-factor amendment means.

[0031] If it finishes photoing the each parts Er1-Er9 which should be photoed and the operation means 60 is operated, as shown in drawing 11, a fundus-of-the-eye image will be displayed on screen 8A by still picture Er1' - Er9' as an overview (panorama picture). Here, the brightness of each still picture Er1' - Er9' is seen and measured, and suppose that there was a still picture with very high brightness or a low still picture.

[0032] In this case, a still picture with the high brightness or a low still picture is clicked and specified on the picture in which cursor is moved by the operation means 60, such as a mouse, and cursor is located. Then, the brilliance-control virtual slide knob 62 is displayed on screen 8A at the same time the specified still picture appears in the front face of screen 8A.

[0033] It can consider as the brightness of the still picture which operates the brilliance-control virtual slide knob 62 on a screen by the operation means 60, and adjoins each other, and brightness without sense of incongruity, each still picture is continuously connected without sense of incongruity, and the whole image examined the eyes can be compounded.

[0034] Moreover, each still picture Er1' - Er9' may be displayed on drawing 12 in parallel, the luminosity of each still picture Er1' - Er9' may be seen and compared, brilliance-control specification may be performed to every each still picture Er1' - Er9', and the brilliance control for every still picture may be performed.

[0035] Since light emitting diodes 51b-51i as \*\*\*\*\* were considered as the square-like array the center [ light emitting diode 51a ], although there is the advantage in which the lap portion of the still picture (fundus-of-the-eye image) of an adjoining



fundus-of-the-eye part shown in drawing 11 can be lessened, with the form of implementation of this invention As shown in drawing 13 (a), while arranging light emitting diodes 51b-51i on a periphery focusing on light emitting diode 51a As shown in drawing 13 (b), the pinholes 52a-52i of the mask board 52 are made to correspond to light emitting diodes 51a-51i, and it arranges, and you may make it display still picture Er1' - Er9' on screen 8A, as shown in drawing 14.

[0036] Although it enables it to photo the fundus-of-the-eye image within the limits of 80 degrees centering on the center of the fundus of the eye, you may enable it to photo the fundus-of-the-eye image within the limits of 100 degrees and 120 degrees here.

[0037] Moreover, arbitrarily, using movable \*\*\*\*\* which can be repositioned as internal \*\*\*\*\*, as shown in drawing 15 While changing the fundus-of-the-eye part which should be photoed by displaying the circular frame Ci in the center of screen 8A before photography, displaying as an animation the fundus-of-the-eye part which should be photoed in this screen 8A, and following movable \*\*\*\*\* on carrying out a variation rate from a criteria position You may make it change the position of the circular frame on screen 8A from a mid gear according to the amount of displacement from the criteria position of movable \*\*\*\*\*.

[0038] Although the form of implementation of the above invention explained the case where a panoramic exposure was performed using internal \*\*\*\*\*, you may be made to take a photograph using external \*\*\*\*\*.

[0039] The range which should be photoed when taking a photograph using external \*\*\*\*\* is wide range, and the \*\* person is taking a photograph by [ as adjoining photography images' overlapping considerably ], as it depends on experience and intuition so that it may photograph and there may be no remnants part, and shown in drawing 16. The state where the pictures which adjoin the drawing 16 mutually [ the still picture of 15 sheets of signs Er1-Er15 ] overlapped in most portion is shown.

[0040] Therefore, when the panoramic exposure of a fundus-of-the-eye image was conventionally performed using external \*\*\*\*\*, photography number of sheets increased and there was a problem of wasting a film. Then, as shown in drawing 17, while changing the animation as a fundus-of-the-eye part which displays the circular frame Ci on a part for the center section of screen 8A, and is displayed on screen 8A with guidance examined the eyes according to external \*\*\*\*\* within the circular frame Ci It is made to correspond to the amount of displacement from the criteria position of external \*\*\*\*\*, and you may make it move relatively the still picture [ finishing / photography ] to the circular frame Ci on screen 8A. Here, still picture Er4' is displayed on screen 8A as a still picture [ finishing / photography ].

[0041] A panorama picture can be acquired lessening the lap of the fundus-of-the-eye image which adjoins, grasping correctly the physical relationship over the still picture of the animation in the circular frame Ci which it is going to photo from now on, seeing the fundus-of-the-eye image as a still picture of screen 8A according to this thing as much as possible.

[0042]

[Effect of the Invention] The effect that a photograph can be taken grasping intuitively an interrelation with the photography part which photography has already finished while observing the part which it is going to photo from now on and which should be photoed according to the ophthalmology photography equipment of this invention according to claim 1, and a panorama picture can be acquired is done so.

[0043] Since according to the ophthalmology photography equipment of this invention according to claim 2 it displays on the center section of the screen by making an observation part into an animation and the still picture displayed the part on the periphery of a screen, without reducing most observation parts, it can display on a screen and a still picture and an observation part can be associated.

[0044] According to ophthalmology photography equipment given in the claims 3 and 4 of this invention, the change of a photography scale factor based on the diopter examined the eyes can be rectified, each adjacent still picture can be connected with a more sufficient precision, and by making especially a fundus-of-the-eye image into a panorama picture, on a screen, the blood vessel of each fundus-of-the-eye part is connected correctly, and can be displayed.

[0045] A specification means to specify on a screen either of each still picture displayed on the screen by relating mutually according to the ophthalmology photography equipment of this invention according to claim 5, Since it has a brilliance-control means to adjust the brightness on the screen of the still picture specified by this specification means, even when the brightness of each still picture displayed on the screen differs, the effect that each still picture is continuously connected without sense of incongruity, and the whole image examined the eyes can be compounded is done so.

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[Translation done.]



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**CLAIMS**

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[Claim(s)]

[Claim 1] After observing the part which should be photoed as the whole eye examination-ed portion as an observation part, It is ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography, and is displayed on a screen as a panorama picture.

Ophthalmology photography equipment characterized by establishing a display-control means to control so that it relates with the aforementioned still picture and the aforementioned observation part is displayed on the aforementioned screen by the animation.

[Claim 2] The aforementioned display-control means is ophthalmology photography equipment according to claim 1 characterized by controlling so that the still picture which the aforementioned observation part is displayed on a part for the center section on the aforementioned screen, and is related with the aforementioned observation part is displayed on the periphery on the aforementioned screen.

[Claim 3] Ophthalmology photography equipment according to claim 1 with which the display scale factor on the aforementioned screen is prepared in the amendment display scale-factor amendment means based on the diopter examined [ aforementioned ] the eyes.

[Claim 4] Ophthalmology photography equipment according to claim 3 characterized by the aforementioned part which should carry out photography being a fundus-of-the-eye part.

[Claim 5] Ophthalmology photography equipment which associates mutually the still picture which photoed the aforementioned part which should carry out photography and was obtained by this photography after observing the part which should be photoed as the whole eye examination-ed portion characterized by providing the following as an observation part, and is displayed on a screen as a panorama picture. A specification means to specify on a screen either of each still picture displayed on the aforementioned screen by relating mutually. A brilliance-control means to adjust the brightness on the screen of the still picture specified by this specification means.

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[Translation done.]

